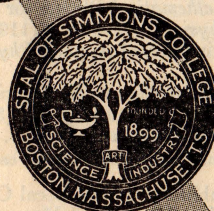
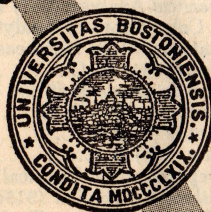
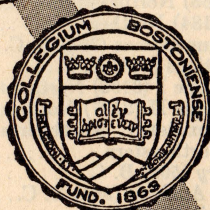
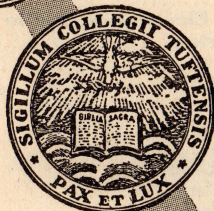
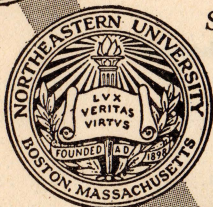
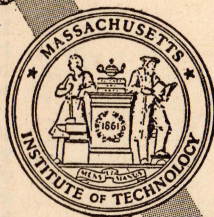


Mr. Leitch



# ENGINEERING SCIENCE AND MANAGEMENT WAR TRAINING COURSES

*Sponsored by United States Office of Education  
and Offered in Metropolitan Boston by*

Harvard University  
Massachusetts Institute of Technology  
Northeastern University  
Tufts College  
Boston College  
Boston University  
Simmons College  
Wellesley College

TWELFTH EDITION  
APRIL 1944

TOTAL 54  
UTI 36

*Address all Inquiries to*  
**WAR TRAINING BUREAU**

Room 7-102

Massachusetts Institute of Technology  
Cambridge 39, Massachusetts  
Kirkland 6900—Extension 789



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Published by the Local Committee of the Metropolitan Boston Area of Region 1, Engineering Science and Management War Training Division, United States Office of Education  
April, 1944

**IMPORTANT: In courses with heavy registrations, preference will be given to women, and to men not immediately affected by the Selective Service Registration. Many courses are limited to persons employed by defense industries.**



# Engineering Science and Management War Training Courses

## GENERAL INFORMATION

This program, offered by Harvard University, Massachusetts Institute of Technology, Northeastern University, Tufts College, Boston College, Boston University, Simmons College, and Wellesley College, includes **full-time day** courses for **men and women**, as well as **evening studies** for *men and women* who are employed.

Organized under the Engineering Science and Management War Training Program of the United States Office of Education, this plan is part of a national project supported by the government for specialized training in fields essential to the war effort. The courses are given without charge to students for tuition. Students are expected to meet other expenses.

All courses are of collegiate grade but the requirements for admission vary with the scope and intensity of each course. These requirements extend from high school graduation only, to engineering or science degrees. **Specific prerequisites are given in the description of each course.** The courses proposed in this program are subject to approval by the United States Office of Education. They are also contingent upon the demand for such studies, as shown by inquiries and applications. Other courses will be offered if the demand warrants, and the courses now listed may be repeated if circumstances permit. Additional demands by war agencies upon schools offering, and upon staffs presenting these courses, may change or cancel any course listed.

**Applicants for registration in these courses must fill out the enclosed application in complete detail. Indicate the course and course number for which you wish to register. This application must then be mailed to the War Training Bureau, Room 7-102, Massachusetts Institute of Technology, Cambridge 39.**

Applicants will be notified by the school offering the individual courses as to *tentative* acceptance for a course. Final acceptance may be contingent upon personal interviews.

The size of classes must necessarily be limited to effective working groups; therefore it is important that applicants furnish complete information at the outset.

In general, the courses will start between April 25 and July 20, 1944. Lengths of courses vary from six to sixteen weeks.

Applications for a course should be received not later than one week before the starting date.



## ✓ Cost Accounting (710)

### Part Time Evening Course

*Purpose of Course.* To train those who are familiar with the basic accounting procedures in the techniques of cost records so as to secure better control and accurate costs in manufacturing enterprise.

*Qualifications for Admission.* High school graduates with a knowledge of elementary accounting and with business experience.

*Length of Course.* Eight weeks — two two-hour classes per week. Total, including preparation, 96 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Simmons College, The Fenway, Boston.

*Course Content.* Cost data and their uses; control records; job and process cost accounting; estimated and standard costs; unit costs; distribution of expenses; integration of cost systems with the general accounting records.

## ✓ Industrial Cost Accounting (3185)

### Part Time Evening Course

*Purpose of Course.* To provide intensive training in the basic principles of cost accounting as they pertain to war industry.

*Qualifications for Admission.* Training or experience providing knowledge of elementary accounting. High school graduates with extensive experience as cost clerks or in shop practice and production work may be qualified for admission. Employer endorsement required.

*Length of Course.* Eight weeks — two three-hour classes per week. Total, including preparation, 80 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Purposes and uses of cost accounting; control and costing of materials, labor, and overhead; inventory and budgetary controls; job orders, process costs, estimated costs, standard costs; war contract accounting.

## ✓ Analytical Geometry and Introduction to Calculus (3148)

### Part Time Evening Course

*Purpose of Course.* To train men and women in the more advanced mathematical techniques for service in engineering offices and scientific laboratories.

*Qualifications for Admission.* High school graduation, including mathematics courses providing thorough knowledge of algebra and trigonometry.

*Length of Course.* Fifteen weeks — two two and one-half hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning May 8, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Rectangular and polar coordinates; equations and graphs; straight line and circle; parabola, ellipse, hyperbola; general second degree equations; methods of analysis of technical and empirical curves. Introduction to differential calculus, including rates, velocity, maxima and minima problems and integral calculus through area problems. Simple applications with interesting practical problems are considered to develop interest and prepare a solid foundation for the study of the calculus.



## Cathode Ray Oscilloscopes (3149)

### Part Time Evening Course

*Purpose of Course.* To provide radio technicians with a comprehensive knowledge of the cathode ray oscilloscope and its applications.

*Qualifications for Admission.* High school graduation, including courses in mathematics and physics plus additional training or experience in radio. Employer endorsement required.

*Length of Course.* Twelve weeks — two three-hour classes per week, lecture and laboratory. Total, including preparation, 150 hours.

*When Given.* Beginning May 16, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Oscillographs, origin of cathode ray tube and development, elementary electron optics, electrostatic and magnetic deflection, the fluorescent screen, sweep circuit oscillators. Uses of the cathode ray oscillograph, including measurement of voltage and current, frequency measurement, time intervals, wave form analysis, checking distortion, modulation percentage. Electronic switches. Cathode ray power supplies. Complete oscillograph circuits analyzed. Wobblers for making frequency curves.

## Elements of Applied Chemistry (566)

### Part Time Day Program

*Purpose of Course.* To provide intensive chemistry training for laboratory assistants in industry.

*Qualifications for Admission.* Graduation from an approved high school, preferably with one year of high school chemistry.

*Length of Course.* Nine weeks — five three-hour classes per week. Mondays through Fridays from 9 a.m. to 12 noon. Total, including preparation, 300 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College (Science Building), Chestnut Hill (Newton).

*Course Content.* This course will give a thorough survey of the field of inorganic chemistry, comprising a systematic study of the more important elements and their compounds, with some emphasis placed on the strategic materials of defense. The fundamental laws and theories of chemical reactions and the calculations based thereon will be stressed in lectures. The demonstration laboratory work is designed to develop technique, to illustrate the fundamental laws and theories of chemistry, and to enable the student to acquire basic knowledge of the properties of common chemicals. Each session will consist of one hour of lecture and two hours of laboratory.

## Qualitative Organic Chemical Analysis (565)

### Part Time Evening Course

*Purpose of Course.* To provide training in the identification of organic compounds for chemists in industry and for those who are preparing for more advanced work.

*Qualifications for Admission.* An elementary course in organic chemistry.

*Length of Course.* Seven weeks — three three-hour classes per week on Monday, Wednesday and Friday evenings from 7 to 10 p.m. Total, including preparation, 100 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College (Science Building), Chestnut Hill (Newton).

*Course Content.* This is primarily a laboratory course. It takes up the general reactions of organic compounds and the systematic methods of their identification. The student will identify a number of simple and mixed organic compounds.



## ✓ Quantitative Chemical Analysis (567)

### *Part Time Evening Course*

*Purpose of Course.* To provide training in industrial chemical laboratory routine analysis.

*Qualifications for Admission.* Graduation from high school and one year of college chemistry, or equivalent.

*Length of Course.* Fifteen weeks — three three-hour classes each week, 7 to 10 p.m., Monday, Wednesday and Friday evenings. Total, including preparation, 300 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College (Science Building), Chestnut Hill (Newton).

*Course Content.* This course consists of practical laboratory work to prepare qualified students for routine analysis in the chemical laboratory. It will stress the use of analytical balances, the preparation and standardization of solutions, the analysis of basic materials by standard volumetric and gravimetric procedures, and will include some work on the more rapid colorimetric method using the visual and photo-electric colorimeter. Part of the time will be taken to demonstrate technique, to explain the theory involved, and to illustrate the calculation of analytical results.

## ✓ Techniques and Calculations of Analytical Chemistry (714)

### *Part Time Day Program*

*Purpose of Course.* To train women and men not immediately affected by the Selective Service Registration for positions as technical aides in the chemistry control laboratories in war industries.

*Qualifications for Admission.* Graduation from high school with courses in algebra and chemistry.

*Length of Course.* Eight weeks of part time instruction daily from 9 a.m. to 12 noon, Monday through Friday, totalling 120 hours of classroom and laboratory work.

*When Given.* Beginning June 19, 1944.

*Where Given.* Simmons College, The Fenway, Boston.

*Course Content.* Chemical arithmetic, solutions of electrolytes, neutralization, titration, oxidation-reduction, weighing, precipitation and filtration, and gravimetric analysis.

## ✓ Differential Equations (3150)

### *Part Time Evening Course*

*Purpose of Course.* To provide advanced mathematics as a basis for research and design problems which are being met in war industry by the engineer and scientist.

*Qualifications for Admission.* Mathematics through differential and integral calculus.

*Length of Course.* Fifteen weeks — two two and one-half hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning May 1, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Complete solution of differential equations through the linear type with special consideration given to types of the second order. Problem work will have definite application to the fields of electricity, chemistry, physics, and mechanics.



## **Advanced Engineering Drawing (2119)**

### *Part Time Evening Course*

*Purpose of Course.* To provide training suitable for draftsmen in government and defense industries.

*Qualifications for Admission.* Successful completion of E.S.M.W.T. Course in Engineering Drawing 3116, or the equivalent.

*Length of Course.* Twenty weeks — two two and one-half hour classes per week. Total, including preparation, 130 hours.

*When Given.* Beginning about July 11, 1944.

*Where Given.* Massachusetts Institute of Technology.

*Course Content.* Working drawings developed through the sketch, detail drawing, assembly drawing. Advance auxiliary projection and practical three-dimensional problems. Intersections and developments of practical surfaces.

## **Elementary Engineering Drawing (3182)**

### *Part Time Evening Course*

*Purpose of Course.* To provide intensive preliminary training for men and WOMEN to fit them for drafting work in war industries and the government service.

*Qualifications for Admission.* High school graduation, including two years of mathematics.

*Length of Course.* Fifteen weeks — two three-hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Use of instruments, lettering, geometric constructions, orthographic projections, including auxiliary views and isometric drawing, developments for sheet metal work, screw threads and common fastenings, sections, dimensioning, tracing and inking, detail and assembly drawing.

## **Machine Drawing (3189)**

### *Part Time Evening Course*

*Purpose of Course.* To provide training in standard drafting room practice which will be useful to draftsmen in fitting themselves for machine design.

*Qualifications for Admission.* High school graduation plus courses or experience equivalent to Elementary Engineering Drawing. Preference will be given to applicants engaged in machine drafting and endorsed by employers.

*Length of Course.* Fifteen weeks — two three-hour classes per week. Total, including preparation, 180 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* The course includes preliminary machine sketches, detailing from machines and from assembly drawings, dimensions with reference to basic size system, sectioning and the making of assembly drawings from details, problems in fastenings, bearings, belts and pulleys, gears, cams, clutches, couplings, piping.



## Elementary Electricity I (3180)

### Part Time Evening Course

*Purpose of Course.* To provide training in basic electricity for persons now employed in war industries so that they will be better equipped to engage in the production of electrical goods.

*Qualifications for Admission.* High school graduation, including one year of mathematics. Employer endorsement required.

*Length of Course.* Twelve weeks — two two-hour classes per week. Total, including preparation, 100 hours.

*When Given.* Beginning July 10, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of algebra. Magnetism, electrostatics, Ohm's law, electric circuits in series and parallel, electric power and energy; theory, operation and control of D.C. motors and generators; study of complete electrical systems, including a generator supplying resistance and motor load, and including line losses, voltage drops, efficiency, etc.

## Elementary Electricity II (3181)

### Part Time Evening Course

*Purpose of Course.* To provide training in basic electricity for persons now employed in war industries so that they will be better equipped to engage in the production of electrical goods.

*Qualifications for Admission.* High school graduation, including one year of mathematics, plus Elementary Electricity I or its equivalent. Employer endorsement required.

*Length of Course.* Twelve weeks — two two-hour classes per week. Total, including preparation, 100 hours.

*When Given.* Beginning July 10, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of trigonometry. A comprehensive coverage of the principles of alternating current, including vector diagrams and solution; vector relationship in circuits containing resistance, reactance and impedance; current and voltage relationship in series and parallel circuits; power and power factors; polyphase systems; delta versus wye connections; transformers; alternators; A.C. motors, starters and controllers.

## Industrial Electronics I (3186)

### Part Time Evening Course

*Purpose of Course.* To provide fundamental knowledge of the various electron tubes and their applications in the industrial field.

*Qualifications for Admission.* High school graduation with basic knowledge of electricity. Acceptance will be based upon educational qualifications. Preference will be given to those engaged in this field of activity in war industry. Employer endorsement required.

*Length of Course.* Twelve weeks — two three-hour lecture and one three-hour laboratory classes per week. Total, including preparation, 180 hours.

*When Given.* Beginning July 6, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of D.C. and A.C. circuit, thermionics, secondary and photo-electric emission. Space charge and ionization. Diodes, triodes, tetrodes, pentodes, beam tubes. Rectifiers; electronic, and gaseous voltage regulators. Direct coupled, R.C. coupled, and power amplifiers.



## Industrial Electronics II (3187)

### Part Time Evening Course

*Purpose of Course.* To provide further knowledge in the theory of electronic devices and their applications in the industrial field.

*Qualifications for Admission.* High school graduation with basic knowledge of electricity, plus course in Industrial Electronics I or the equivalent in training and experience. Preference will be given to those engaged in this field of activity in war industry. Employer endorsement required.

*Length of Course.* Twelve weeks — two three-hour lecture and one three-hour laboratory classes per week. Total, including preparation, 180 hours.

*When Given.* Beginning July 7, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Vacuum tube voltmeters, oscillators, applications of thyratrons, ignitrons and photo-electric cells; industrial uses of the cathode ray oscilloscope; motor controls, induction and dielectric heating, resistance welding devices, timer circuits.

## Introduction to Engineering (3168)

### (BASIC TRAINING FOR WAR INDUSTRY AND THE MILITARY SERVICES)

#### Full Time Day Program

*Purpose of Course.* To provide basic training for:

1. Men and women to enter technical and testing positions in WAR INDUSTRY.
2. High school graduates about to enter the military services, especially those planning to take the EDDY TEST — a qualifying examination used by the UNITED STATES NAVY to select trainees as radio technicians.
3. Men and women who may wish to qualify for CIVIL SERVICE APPOINTMENTS as Technical and Scientific Aids.

*Qualifications for Admission.* High school graduation, including one year of mathematics.

*Length of Course.* Ten weeks — full time, 9 a.m. to 5 p.m., Mondays through Fridays. Total, including preparation, 500 hours.

*When Given.* Beginning Monday, June 19, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

#### Course Content.

**MATHEMATICS.** Algebraic processes, factoring, simple equations, simultaneous linear equations, quadratic equations, mensuration, logarithms, use of slide rule and tables, trigonometrical functions, solution of right triangles, solution of oblique triangles, forces acting on rigid bodies, static equilibrium, graphical methods for solution of problems.

**PHYSICS.** Laws of motion, force, work, energy, friction, liquids, gases, measurement and transfer of heat, nature and propagation of light, magnetism, Ohm's law, direct current, alternating current, simple electrical circuits.

**ENGINEERING DRAFTING.** Use of instruments, lettering, geometric constructions, free-hand sketching, orthographic projection including primary auxiliary views and isometric drawing. Development for sheet metal parts, detailing of machine parts, simple assembly drawings.

**PRODUCTION PROCESSES.** Plant and shop organization, manufacture and processing of metals, fabrication and assembly, tests and specifications. Emphasis will be placed on acquainting the students with the techniques of production.



## Frequency Modulation (3155) X

### Part Time Evening Course

*Purpose of Course.* To train radio technicians in the theory and operation of frequency modulated systems, including installation and maintenance of equipment similar to that used in the military services.

*Qualifications for Admission.* High school graduation plus completion of Fundamentals of Radio II or equivalent. Employer endorsement required.

*Length of Course.* Ten weeks — two three-hour classes per week, lecture and laboratory. Total, including preparation, 120 hours.

*When Given.* Beginning May 16, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Fundamental relations of amplitude, frequency and phase modulation. Methods of producing frequency modulation in current practice, Armstrong system and reactance modulators. Frequency modulation receivers with limiters, discriminator and de-emphasis circuits. Antennas for frequency modulation transmission and reception. Narrow and wide band systems.

## Applied Geometry for Draftsmen (2118) ✓

### Part Time Evening Course

*Purpose of Course.* To give draftsman further training in the advanced phases of engineering drawing and the use of Applied or Descriptive Geometry.

*Qualifications for Admission.* Successful completion of E.S.M.W.T. Courses in Elementary and Advanced Engineering Drawing, or equivalent.

*Length of Course.* Fifteen weeks — two three-hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning July 11, 1944.

*Where Given.* Massachusetts Institute of Technology.

*Course Content.* The solutions of the fundamental problems of space geometry by the method of orthographic projection. The application of these fundamental constructions to problems in engineering drawing and lofting which involve the determination of distances, angles, intersections, developments, and other geometrical relationships. Also the application of conics to the design of a fair surface to suit given conditions. Emphasis is placed on the development of the type of visual imagination useful in the design of mechanical arrangements.

## Drawing Board Geometry (3179) ✓

### Part Time Evening Course X

*Purpose of Course.* To provide advanced training for draftsmen, designers and layout men engaged in government service and war industry.

*Qualifications for Admission.* High school graduation, including mathematics, and completion of course similar to Elementary Engineering Drawing (3182) or the equivalent in training and experience. Employer endorsement required.

*Length of Course.* Fifteen weeks — two three-hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* An advanced study of the theory of projection (Descriptive Geometry) Projection studies of point, line, plane, and solid; secondary auxiliary projection, intersections of plane and of curved surfaces, and development. Graphical solution of practical problems. This course will particularly be valuable to persons engaged in machine design, aeronautical design, structural design, sheet metal layouts, etc.



## Industrial Inspection (3188)

### *Part Time Evening Course*

*Purpose of Course.* To instruct persons engaged in inspection work, within war industries, concerning standard types of inspection instruments and gages and some of the established inspection procedures.

*Qualifications for Admission.* High school graduation or its equivalent in training and experience. Employer endorsement required.

*Length of Course.* Twelve weeks — two two-hour classes per week, lecture and laboratory. Total, including preparation, 90 hours.

*When Given.* Beginning July 17, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Mathematics review, including mensuration, units and standards of measurement. Lectures and laboratory practice with standard measuring instruments and gages for mechanical inspection; linear, surface, and angular measurements; "go and not-go" gages of various types. Gage blocks. Discussion of optical measuring and gaging practice. Some visual inspection techniques. Discussion of tolerance limitations of machine tools and other processing equipment in common use.

## Industrial Relations (711)

### *Part Time Evening Course*

*Purpose of Course.* To prepare persons for industrial relations work in the personnel departments of industry.

*Qualifications for Admission.* Two years of study in an approved college or university, and appropriate personal qualifications; preference will be given to college graduates.

*Length of Course.* Eight weeks — two two-hour classes per week. Total, including preparation, 96 hours.

*When Given.* Beginning June 13, 1944.

*Where Given.* Simmons College, The Fenway, Boston.

*Course Content.* Recent and probable future trends in industrial relations; survey of the labor movement in the United States; employer-employee relationships; negotiation and collective bargaining; obligations of employers to labor unions as expressed in Federal and State Labor Relations Acts; trend of Federal and State laws on social security, unemployment insurance, wages and health regulations.

## Optical Instruments (Theory and Practice) (564)

### *Part Time Evening Course*

*Purpose of Course.* To provide training in the fundamental principles of geometrical optics, and the design, testing and use of optical instruments based upon these principles. Instruments used by the Army, Navy and Air Corps are preferably discussed.

*Qualifications for Admission.* General physics, elementary algebra and trigonometry. War workers preferred.

*Length of Course.* Fifteen weeks — two three-hour classes per week (lectures four hours, laboratory two hours), on Tuesday and Thursday, 7 to 10 p.m. Total, including preparation, 200 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College (Science Building), Chestnut Hill (Newton).

*Course Content.* Image formation by mirrors and lenses, thick lens and lens systems, limitation of rays by apertures, lens aberrations, resolving power, testing of optical parts, design of optical instruments, photographic objectives, telescopes, periscopes, range finders, microscopes, theodolites, projection systems, searchlights, etc.



# War Industry Training Course (107)

## Full Time Day Program

**Purpose of Course.** To facilitate the transfer to war production of men displaced from their normal occupations by training them for supervisory positions in war industry. To upgrade supervisory personnel now employed in war production plants, fitting such men for positions of greater responsibility.

**Qualifications for Admission.** The applicant must be between the ages of 35 and 60 years. He must have demonstrated in his peacetime business experience qualifications of ability, leadership, and adaptability indicating that he is capable of doing the intensive work that is required by the program of study and that, when retrained, he will fit into a supervisory position under wartime conditions. Ordinarily, satisfactory completion of at least two years' work in a college of recognized standing will be required. Men on leave from war production plants are obligated to return to their respective companies upon completion of the course. (Appointments for personal interviews may be made by calling Kirkland 9800.)

**Length of Course.** Thirteen weeks — 44 hours of classes and supervised study plus one lecture of one and one-half hours a week. Total, including preparation, 780 hours.

**When Given.** Beginning May 15 and September 18, 1944.

**Where Given.** Baker Library, Harvard University Graduate School of Business Administration.

### Course Content.

**COST ADMINISTRATION IN INDUSTRY.** Basic orientation in industrial costs, providing an appreciation of the control, interpretative aspects of operating statements and manufacturing cost statistics.

**INDUSTRIAL PROCUREMENT.** The procurement of equipment, supplies, and materials with particular attention to the relation of the purchasing function to the other major functions of the business; organization and procedure under war conditions; purchase contract forms and clauses; purchase quantities; inventory control; determination of sources; priority and allocation problems; expediting deliveries; subcontracting; price policies.

**PERSONNEL AND MANAGEMENT CONTROLS.** The problem of securing action through personnel, internal company reports and controls at different levels of management, budgetary procedure as an aspect of control, and building an organization in the lower supervisory levels under war conditions.

**PRODUCTION ORGANIZATION AND ENGINEERING.** The technical and industrial engineering background required of men who enter war industry at the supervision level, including blueprint reading, the functions of the principal machine tools, and specialized functional (staff) activities.

**THE SUPERVISOR AND UNION LABOR.** The operating problems of the line supervising dealing with union representatives; the day-by-day problems of operating a plant under a union contract.



## Pressure and Flow Measuring Instruments (3192)

### *Part Time Evening Course*

*Purpose of Course.* To provide training for persons engaged in the testing of mechanical equipment in the underlying principles involved in the measurement of gaseous and liquid flows; the principles of operation and limitations of flow measuring devices and temperature and pressure measuring instruments; also the study of methods of measuring mechanical power.

*Qualifications for Admission.* High school graduation including mathematics. Applicants will be accepted on basis of educational background and experience on work directly connected to the course content.

*Length of Course.* Twelve weeks — two three-hour classes per week, lecture and laboratory. Total, including preparation, 150 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Elements of thermodynamics, including the general energy equation, perfect gas law, adiabatic and polytropic laws. The course will include lecture and laboratory work with various types of thermometers, mercury, thermocouples, etc., pressure measuring instruments, i.e. barometers, manometers, Bourdon gage, etc.; flow measuring instruments, i.e. orifices, nozzles, Venturi tube, Pitot tube, anemometer, etc., with application to steam flow, air flow and internal combustion engine testing, both gasoline and diesel. Calibration tests will be run on several of the flow measuring instruments.

## Alternating Current Machinery (3177)

### *Part Time Evening Course*

*Purpose of Course.* To upgrade qualified persons employed in the electrical testing, installation and inspection fields.

*Qualifications for Admission.* High school graduation plus completion of course similar to Elements of Electricity II (3181) or the equivalent in training and experience. Employer endorsement required.

*Length of Course.* Twelve weeks — two three-hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of A.C. circuits. Principles, characteristics, operation and testing of transformers, transformer connections on polyphase circuits, polyphase induction motors, alternators, synchronous motors, and single-phase motors. Motor control methods and equipment.

## Direct Current Machinery (3178)

### *Part Time Evening Course*

*Purpose of Course.* To provide training for the upgrading of qualified persons engaged in electrical testing, installation and inspection work.

*Qualifications for Admission.* High school graduation plus completion of course similar to Elements of Electricity I (3180) or the equivalent in training and experience. Employer endorsement required.

*Length of Course.* Twelve weeks — two three-hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of D.C. and magnetic circuits. General principles, characteristics, operation, and testing of D.C. generators and motors. Commutation, heating, efficiency and rating of D.C. machines. Motor control apparatus. Parallel operation of D.C. generators. Storage batteries.



## Topographical and Aerial Mapping (3195)

### *Part Time Evening Course*

*Purpose of Course.* To acquaint trainees with fundamental principles of topographical and photogrammetric surveying for persons engaged in civil and military engineering work related to highways, drainage areas, transmission lines, airports, etc.

*Qualifications for Admission.* High school graduation plus knowledge of fundamentals of plane surveying.

*Length of Course.* Sixteen weeks — two three-hour classes per week. Total, including preparation, 180 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Types of aerial cameras and controls, vertical and oblique photographs with uses and limitations, identification of physical features. Use of stereoscopic equipment, including simple stereoscope and stereocomparograph (contour finders). Horizontal and vertical controls, controlled and uncontrolled mozaics and introduction to tri-metrogon method of mapping.

## Advanced Mathematics (570)

### *Part Time Evening Course*

*Purpose of Course.* To give a thorough review to trained personnel and to equip prospective engineers with the advanced mathematics so essential to their work.

*Qualifications for Admission.* College mathematics through the differential and integral calculus.

*Length of Course.* Fifteen weeks — three three-hour classes per week. Classes meet Monday, Wednesday and Friday evenings from 7 to 10 p.m. Total, including preparation, 300 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College, Chestnut Hill (Newton).

*Course Content.* Differential equations. A treatment of ordinary differential equations including the principal types of first and second order equations, etc. The work is illustrated by numerous applications to geometry, chemistry, physics, and mechanics.

## Applied Mathematics (569)

### *Part Time Evening Course*

*Purpose of Course.* To provide the mathematical tools that are required for many of the E.S.M.W.T. courses.

*Qualifications for Admission.* At least one year of college mathematics.

*Length of Course.* Fifteen weeks — three three-hour classes per week. Classes meet Monday, Wednesday and Friday evenings from 7 to 10 p.m. Total, including preparation, 300 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College, Chestnut Hill (Newton).

*Course Content.* Differential and integral calculus. Includes curve plotting, functions, formal work in differentiation rates, extremes, etc. Also integration of simple functions, including arc length, area, center of gravity, etc.



## Basic Mathematics (568)

### *Part Time Day Program*

*Purpose of Course.* To train men and women for service in the engineering offices and scientific laboratories of war plants, and wherever else they may be useful to the war effort.

*Qualifications for Admission.* High school graduation from a course which included algebra, geometry and preferably physics.

*Length of Course.* Seven weeks — five three-hour classes per week. Classes meet daily, Monday through Friday, from 1 to 4 p.m. Total, including preparation, 225 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College, Chestnut Hill (Newton).

*Course Content.* A review of the fundamentals of algebra through quadratics; those parts of plane and solid geometry which have direct application to engineering work; and a thorough treatment of trigonometry and its applications.

## Mathematical Preparation for Physical Chemistry (712)

### *Part Time Evening Course*

*Purpose of Course.* To provide a mathematical background for understanding papers on physical chemistry in the scientific literature by chemists in industry.

*Qualifications for Admission.* High school graduation, including one year of algebra and one year of plane geometry and a rudimentary knowledge of trigonometry.

*Length of Course.* Twelve weeks — two two and one-half hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning June 13, 1944.

*Where Given.* Simmons College, The Fenway, Boston.

*Course Content.* Exponents, logarithms, and the slide rule; the analytical geometry of first and second degree equations, logarithmic, exponential, and trigonometric functions; derivatives and integrals with applications; partial differentiation; elementary differential equations; infinite series; probability.

## Engineering Mathematics Review (3154)

### *Part Time Evening Course*

*Purpose of Course.* To provide mathematics review to engineers and technicians to upgrade and qualify them for E.S.M.W.T. courses requiring advanced mathematics.

*Qualifications for Admission.* Two years of college mathematics through differential and integral calculus.

*Length of Course.* Fifteen weeks — two two and one-half hour classes per week. Total, including preparation, 150 hours.

*When Given.* Beginning May 8, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* A comprehensive review of analytical geometry, differential and integral calculus with an introduction to differential equations.



## Mechanisms (3190)

### Part Time Evening Course

*Purpose of Course.* To provide training in elementary mechanical design for war industry.

*Qualifications for Admission.* Two years in engineering college or the equivalent, including mathematics through trigonometry, physics through mechanics, and elementary engineering drawing. Employer endorsement required.

*Length of Course.* Fifteen weeks — two three-hour classes per week. Total, including preparation, 180 hours.

*When Given.* June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* The course deals with the basic principles of mechanical design embodying graphical and mathematical solution of problems involving study of the paths of mechanical movements and their applications to velocity diagrams, quick return mechanisms, cams, etc. It includes vector analysis in respect to velocity and acceleration; linkages; bearings; gear tooth design and gear trains, including epicyclic trains; cam design; differential screws; belts and rope drives.

## Methods Engineering (3191)

### Part Time Evening Course

*Purpose of Course.* To provide training for those now engaged in war production to enable them to increase production.

*Qualifications for Admission.* Two years of an engineering school course of study or the equivalent in training and experience. High school graduates with extensive experience in shop practice and production may be qualified for admission. Employer endorsement required.

*Length of Course.* Sixteen weeks — one three-hour class per week. Total, including preparation, 80 hours.

*When Given.* Beginning June 5, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Process and operation analysis through the use of process charts, flow diagrams, operation charts, man-and-machine charts, micromotion study, principles of motion economy. Work place layout, labor-saving tools and equipment, laboratory development work. Elementary time study. Setting up synthetic standards using elemental time values. Wage incentives, problems involved in the introduction of work simplification with particular emphasis upon employee morale.

## Advanced Motion Study (3175)

### Part Time Evening Course

*Purpose of Course.* To train persons now engaged in motion study or methods engineering work for war industries in the principles and techniques of advanced work in this field.

*Qualifications for Admission.* E.S.M.W.T. course in Methods Engineering (3191) or its equivalent, or not less than one year of acceptable experience in industrial methods and motion study. Employer endorsement required.

*Length of Course.* Fifteen weeks — one three-hour class per week. Total, including preparation, 75 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of principles of motion economy and operation charts, micromotion study, use of "sino" charts with practical applications, synthetic time values and their use in motion study work. The course will include lecture and laboratory, the laboratory work involving the complete filming and analyzing of selected projects, including one complete laboratory problem in micromotion research.



## Personnel Counseling in Industry (713)

### *Part Time Evening Course*

*Purpose of Course.* To prepare persons to counsel workers in war production, with a view to meeting the problems that have arisen because of the unprecedented increase in the number of new workers in war factories.

*Qualifications for Admission.* Two years of study in an approved college or university, and appropriate personal qualifications; preference will be given to college graduates.

*Length of Course.* Eight weeks — two two-hour classes per week. Total, including preparation, 96 hours.

*When Given.* Beginning June 13, 1944.

*Where Given.* Simmons College, The Fenway, Boston.

*Course Content.* The main divisions and functions of industrial organization; coördination of departments; relations between workers and between management and workers; personnel policies; induction and orientation of new workers; industrial training programs; methods and techniques of counseling; dealing with home, work, and personal problems of employees; promoting safety and health; meeting the need for safe and suitable work clothing; supervision of personnel services; organizing, promoting, and directing recreational and social activities; dealing with causes of absenteeism.

## Mathematical Physics for Women Technicians (648)

### *Full Time Day Program*

*Purpose of Course.* To provide basic training in mathematics and physics necessary to qualify young women as technical assistants in certain government and industrial laboratories where acute shortages in personnel now exist. Typical duties: calculation of firing and bombing tables; construction of statistical charts; observation and recording of experimental data; use of instruments connected with radio and telephone communication; meteorological observations; plotting of curves; solution of equations; numerical and graphical integration; aeronautical and electrical engineering computation; preparation of specifications; elementary engineering design.

*Qualifications for Admission.* High school diploma. High school mathematics, including at least two years of algebra and one of geometry. Some aptitude for mathematics and the sciences.

*Length of Course.* Sixteen weeks, 8.30 a.m. to 4 p.m., Monday through Friday. Total, including preparation, about 600 hours. Lectures, recitations, discussions, laboratory experiments and practice, supervised study.

*When Given.* From July 5 to October 31, 1944.

*Where Given.* Boston University College of Liberal Arts, 688 Boylston Street, Boston.

*Course Content.* Computation, statistics, algebra, trigonometry, analytic geometry, calculus, mechanics, and physics.

There will be no tuition charges. Students will be expected to supply their own books, slide rules, and other supplies. Total cost from \$15 to \$20.

At the conclusion of the course students will be assisted in obtaining positions with the United States Government and with private industry.

Candidates for admission to the course should file application blanks before June 26. Candidates will be notified of the result of their applications about June 30.

Application blanks for admission to the course and further information may be obtained from Mathematical Physics, E.S.M.W.T., 688 Boylston Street, Boston.



## Physics for Teachers (110)

### *Part Time Day Program*

*Purpose of Course.* To equip teachers of other subjects to teach in the field of physics, by providing intensive work in the subject matter necessary for the teaching of high school physics.

*Qualifications for Admission.* Successful preparation for, and experience in, high school teaching. At least rudimentary knowledge of physics is expected.

*Length of Course.* Six weeks — one two-hour class per day on Mondays through Fridays from 10 to 12. Total, including preparation, 150 hours.

*When Given.* Beginning July 3, 1944 and ending August 11, 1944. A class will be held on Saturday, July 8 because of the holiday on July 4.

Course will be repeated in the fall.

*Where Given.* Jefferson Hall, Harvard University. (Information may be obtained by calling Kirkland 7600, Extension 106.)

*Course Content.* This course is designed for men and women who are now successful teachers, and who wish to qualify additionally as teachers of physics. The course will include the topics of the accepted high school physics course and will teach the subject matter knowledge necessary for the teaching of such courses; in addition, the course will include the specialized presentation of material in this field, and such current emphasis in physics teaching as the application of physics to aeronautics, radio, and ordnance.

## Principles of Applied Physics (563)

### *Part Time Evening Course*

*Purpose of Course.* To provide training in the basic matter of all branches of science and engineering.

*Qualifications for Admission.* High school graduation from a course which preferably includes algebra and plane geometry. Preference will be given applicants who have studied trigonometry or otherwise have qualifications beyond the above minimum. Teachers and war workers preferred.

*Length of Course.* Fifteen weeks — three three-hour classes per week (lectures and demonstration problems five hours per week; laboratory four hours per week), Monday, Wednesday and Friday evenings from 7 to 10 p.m. Total, including preparation, 300 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College (Science Building), Chestnut Hill (Newton).

*Course Content.* A systematic presentation of the fundamentals of mechanics, electricity, sound, heat and light with special emphasis on electricity and mechanics.

## Production Planning and Control (3193)

### *Part Time Evening Course*

*Purpose of Course.* To provide training in specific techniques of planning, routing, scheduling, and dispatching for those employed in production work as well as for students and others in training for work of this nature.

*Qualifications for Admission.* Two years of college or engineering school course of study or the equivalent in training and experience. High school graduates with extensive experience in shop practice and production work may be qualified for admission. Employer endorsement required.

*Length of Course.* Ten weeks — one three-hour class per week. Total, including preparation, 60 hours.

*When Given.* Beginning July 10, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Factory organization, factory planning and layout, materials handling, storage, maintenance, power. Forecasting and budgeting, planning, scheduling, routing, dispatching, subcontracting. Quantity control, quality control, waste control, priorities, allocations, controlled materials plan, records and reports.



# Fundamentals of Radio (3167)

## Full Time Day Program

*Purpose of Course.* To prepare men and WOMEN for work in the engineering and testing departments of war industries; particularly to help replace engineers called to service in the armed forces or upgraded to more responsible positions. This training in the basic principles of radio would be helpful to young men about to enter the military services and who might anticipate service in the Signal Corps.

*Qualifications for Admission.* High school graduation, including one year of mathematics. Recent women graduates and applicants with more extensive backgrounds of education or experience will be given preference. Enrollees will be selected on the basis of personal interviews combined with such aptitude tests as may be required.

*Length of Course.* Ten weeks — full time, 9 a.m. to 5 p.m., Mondays through Fridays. Total, including preparation, 500 hours.

*When Given.* Beginning Monday, June 19, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

### Course Content.

**MATHEMATICS.** Fractions, decimals; elementary algebra and its applications; square roots, right triangles; use of graphs, curves, and tables to give practical and experimental information.

**DIRECT CURRENT CIRCUITS.** Electrical units used to measure current, voltage, resistance, and power; batteries; generators; series and parallel circuits; power and heating in electrical circuits; fuses and protective devices; ammeters, voltmeters, ohmmeters, shunts, and multipliers; physical structure of resistors; voltage dividers.

**ALTERNATING CURRENT CIRCUITS.** Alternating current waves; frequency and wave form; A.C. meters; inductances and their behavior under changing currents; physical structure of inductances; condensers and their behavior under changing voltage; physical structure of condensers; reactance; addition of sine waves; phase relations; impedance; power and power factor; series and parallel circuits; series and parallel resonance; mutual inductance and transformers; auto transformers; physical structure of air core and iron core transformers.

**VACUUM TUBE THEORY.** Electron emission — physical nature; direct and indirect heated cathodes; diodes — characteristic curves, plate resistance; triodes — characteristic curves, amplification factor and mutual conductance; multi-grid tubes — reasons for their use, characteristic curves, care of tubes and practical limitations on life.

**VACUUM TUBE APPLICATIONS.** Rectifiers; power supplies; amplifiers — resistance coupled, impedance coupled, transformer coupled; oscillators; cathode ray oscillographs; sweep circuits. Amplifiers used in radio transmitters — tuning requirements; modulators; detectors — crystal and tube.

**WIRE TELEPHONY AND AUDIO SYSTEMS.** Nature of sound, microphones — carbon grain, magnetic and crystal; telephone receivers and loud speakers; multistage audio amplifiers with matching transformers. Simple telephone systems.

**ELEMENTS OF RADIO WAVES.** Fundamentals of electric waves — velocity, frequency (spectrum), wave length; method of radiation and reception; antennas — order of dimension.

**RADIO COMMUNICATION SYSTEM USING AMPLITUDE MODULATION.** Block diagram of component elements; transmitter-oscillator, modulator, amplifier, antenna; medium; receiver-antenna, selective circuit, radio frequency amplifier, detector, audio-amplifier, reproducer; C.W.; I.C.W.; phone transmission.

**RADIO RECEIVERS USING AMPLITUDE MODULATION.** Block diagram of tuned R. F. receiver; tuning; multistage R. F. amplifiers — tendency to oscillate and means of overcoming; shielding; screen grid tube; heterodyne reception of C.W. waves; block diagram of superheterodyne receiver; advantages; principles and methods of mixing; noise limitation on sensitivity of a receiver.

**RADIO TRANSMITTERS USING AMPLITUDE MODULATION.** Block diagram — crystal oscillators; radio amplifier; modulator-code and audio; simple coupling to antenna.



## **Fundamentals of Radio I (3183)**

### *Part Time Evening Course*

*Purpose of Course.* To train radio technicians for branches of the military service; also for radio stations and industry.

*Qualifications for Admission.* High school graduation, plus knowledge of general physics and mathematics.

*Length of Course.* Sixteen weeks — three three-hour classes per week, lectures and laboratory. Total, including preparation, 240 hours.

*When Given.* Beginning July 10, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Mathematics review, D.C. circuits, A.C. circuits, vacuum tube theory, vacuum tube applications, wire telephony and audio systems.

## **Fundamentals of Radio II (3184)**

### *Part Time Evening Course*

*Purpose of Course.* To train radio technicians for broadcasting stations and war industry.

*Qualifications for Admission.* High school graduation, including general physics and mathematics, plus completion of Fundamentals of Radio I, or the equivalent in training and experience. Employer endorsement required.

*Length of Course.* Sixteen weeks — three three-hour classes per week. Total, including preparation, 240 hours.

*When Given.* Beginning July 10, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Elements of radio waves, radio communication systems using amplitude modulation, advanced vacuum tube applications, radio transmitters using amplitude modulation, radio receivers using amplitude modulation, frequency modulation, radio propagation and antennas, laboratory work demonstrating above principles.

## **Mathematics of Radio Communications (562)**

### *Part Time Evening Course*

*Purpose of Course.* To provide intensive training in the mathematics of radio communication.

*Qualifications for Admission.* High school graduation from a course which preferably includes algebra, physics and plane geometry. Preference will be given applicants who have studied trigonometry, radio or otherwise have qualifications above the above minimum. Teachers and war workers preferred.

*Length of Course.* Fifteen weeks — three three-hour classes per week (lecture six hours, problems three hours each week), Monday, Wednesday and Friday evenings from 7 to 10 p.m. Total, including preparation, 300 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College (Science Building), Chestnut Hill (Newton).

*Course Content.* The course will review the prerequisite mathematics and cover the basic mathematics up to and including some of the basic material of differential calculus. Specifically, the elements of algebra, analytical geometry, trigonometry, logarithms and elementary differential calculus will be presented as they apply to radio communications theory and measurements.



## Physics of Radio Communication (561)

### *Part Time Evening Course*

*Purpose of Course.* To train radio technicians for service in the various branches of the Government and in industry, and prepare personnel for more advanced work in this field.

*Qualifications for Admission.* High school graduation from a course which preferably includes algebra, physics and plane geometry. Preference will be given applicants who have studied trigonometry or otherwise have qualifications beyond the above minimum. Enlisted reserves, teachers and war workers preferred.

*Length of Course.* Sixteen weeks — three three-hour classes per week (lectures and demonstration problems, six hours per week; laboratory, three hours per week), Monday, Wednesday, and Friday evenings from 7 to 10 p.m. Total, including preparation, 320 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College, Chestnut Hill (Newton).

*Course Content.* Fundamental electricity, magnetism and electrical circuits leading to and including the functions of the vacuum tube, *i.e.*, rectifier, amplifier, oscillator, modulator, and demodulator. Radiation of energy and antennas will also be considered. Graphical analysis will be stressed throughout the study of the vacuum tube and radiating systems.

## Statistical Methods for Experimentalists (2121)

### *Part Time Evening Course*

*Purpose of Course.* To provide training in statistical methods for workers in industrial and university war laboratories.

*Qualifications for Admission.* Two years of college and some experience in experimental research.

*Length of Course.* Ten weeks — one three-hour class per week (Tuesday). Total, including preparation, about 80 hours.

*When Given.* Beginning about July 15, 1944.

*Where Given.* Massachusetts Institute of Technology.

*Course Content.* The statistical treatment of small and large samples. Statistical principles in the design of experiments. Elimination of bias and reduction of error in experiments. The design of experiments involving many variables. Analysis of experimental data.

## Industrial Statistics (560)

### *Part Time Evening Course*

*Purpose of Course.* To provide intensive training in statistics for such trainees as time study men, laboratory technicians and those who must make intelligent use of figures for administrative purposes.

*Qualifications for Admission.* Two years of college work, including mathematics, an ability to handle quantitative material and at least a responsible position in business.

*Length of Course.* Fifteen weeks — two two-hour classes (Monday and Thursday) per week. Total, including preparation, 180 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Boston College, Chestnut Hill (Newton).

*Course Content.* This course deals with graphic statistics, with the application of the various statistical techniques such as averages, correlation, and sampling errors, to the solving of specific business problems. Likewise, attention will be given to the planning of industrial experiments and the use of certain statistical tools.



## Statistical Methods in Inspection (2120)

### *Part Time Evening Course*

*Purpose of Course.* To provide training in the use of statistical methods in the inspection of materials and in the control of industrial quality.

*Qualifications for Admission.* The applicant should be engaged in production, inspection, testing, or quality control work. No previous knowledge of statistical methods is required, but it is desirable that the applicant have some aptitude for elementary mathematical analysis.

*Length of Course.* Ten weeks — one three-hour class (Monday). Total, including preparation, 75 hours.

*When Given.* Beginning about July 15, 1944.

*Where Given.* Massachusetts Institute of Technology.

*Course Content.* (1) Good and bad sampling methods in inspection. (2) Determination of proper sample sizes. (3) Risks run by sellers and buyers when acceptance inspection is performed on a sampling basis. (4) Single and double sampling. (5) Statistical methods as an aid in controlling the quality of output. (6) Introduction to methods of identifying factors responsible for variable quality.

## Industrial Thermometry (715)

### *Part Time Evening Course*

*Purpose of the Course.* To describe the fundamental principles of the operation of various temperature measuring devices used in industry.

*Qualifications for Admission.* High school graduation, including general physics and elementary algebra.

*Length of Course.* Eight weeks — one two-hour class and one three-hour laboratory per week. Total, including preparation, 100 hours.

*When Given.* Beginning June 13, 1944.

*Where Given.* Simmons College, The Fenway, Boston.

*Course Content.* Uses of various types of thermometers with discussion of errors. Included are liquid in glass, resistance and thermoelectric thermometers, automatic temperature indicators and controls.

## Time Study (3194)

### *Part Time Evening Course*

*Purpose of Course.* To train men and women in the principles and techniques of time study to qualify them for work in war industry, and to upgrade persons already so employed. The course should be helpful to those doing instruction in industry.

*Qualifications for Admission.* High school graduation, including one year of mathematics plus some industrial or business experience. Employer endorsement required.

*Length of Course.* Sixteen weeks — one three-hour class per week. Total, including preparation, 80 hours.

*When Given.* Beginning June 5, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Introduction to wage incentives, history and development of time study, relation to motion and micromotion studies, preliminary observation, technique of making time study. Rating procedure, development of proper concept of "normal" performance, applying the rating and relaxation factors. Setting job and elemental standards, allowances, treatment of variables, development of standard data, synthetic standards, problems in the application of standards. Laboratory practice will supplement the classroom work.



## Advanced Time Study (3176)

### *Part Time Evening Course*

*Purpose of Course.* To train persons now engaged in time study or rate setting work for war industries in the principles and techniques of advanced work in this field.

*Qualifications for Admission.* Completion of E.S.M.W.T. Course in Time Study (3194) or not less than one year of acceptable experience in industrial time study or rate setting work. Employer endorsement required.

*Length of Course.* Fifteen weeks — one three-hour class per week. Total, including preparation, 75 hours.

*When Given.* Beginning June 12, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of stop-watch time study. Use of special timing devices and their relative accuracy; use of motion pictures for rate-setting and training purposes. Study of special operations for time study. Setting up standard data for machine operations. Wage incentive applications. Current trends in wage payment policy and in the use of time study data. Organization of a standards department; presentation of reports. Problems of individual students may be considered.

## Ultra-High Frequency Technique I (3196)

### *Part Time Evening Course*

*Purpose of Course.* To train radio engineers for the federal government and industry, particularly in regard to military and naval requirements.

*Qualifications for Admission.* A Bachelor's degree in electrical engineering or physics, or the equivalent in training and experience. Employer endorsement required.

*Length of Course.* Sixteen weeks — one two-hour lecture and one three-and-one-half-hour laboratory per week. Total, including preparation, 150 hours.

*When Given.* Beginning July 3, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Paths of operation, rectification, electronic regulators, amplifiers, cathode ray tubes and circuits, oscillators, modulators, demodulators, power amplifiers; U.H.F. oscillators, positive and negative grid oscillators, magnetron, klystron; laboratory work covering experiments on audio and radio frequency circuits, including square wave testing, inverse feedback amplifiers, modulation, feedback and resistance-capacitance oscillators, trigger circuits, analysis of the superheterodyne, and coaxial line operation.

NOTE. This course will be followed by Part II, which will include further work on U.H.F. generators, radiation, transmission, propagation, and wave guides.

## Ultra-High Frequency Technique II (3197)

### *Part Time Evening Course*

*Purpose of Course.* To train radio engineers for the Federal Government and industry, particularly in regard to military and naval requirements.

*Qualifications for Admission.* A Bachelor's degree in electrical engineering or physics, plus course in Ultra-High-Frequency Technique I or the equivalent in training and experience. Employer endorsement required.

*Length of Course.* Sixteen weeks — one two-hour lecture and one three-and-one-half-hour laboratory period per week. Total, including preparation, 150 hours.

*When Given.* Beginning July 10, 1944.

*Where Given.* Northeastern University, 360 Huntington Avenue, Boston.

*Course Content.* Review of ultra-high-frequency oscillators, positive and negative grid magnetrons and klystrons followed by mathematical development of Maxwell's field equations and their application to ultra-high-frequency. U.H.F. generators; frequency limits, U.H.F. positive and negative grid oscillators, velocity modulation tubes and circuits, magnetrons. Propagation; general nature of propagation and dependence on frequency. Wave guides; propagation through rectangular and round guides, resonance phenomena in wave guides, applications of resonant elements, practical utilization of wave guides. The laboratory experiments in this course will be performed on various types of ultra-high-frequency generators and associated equipment, including wave guides, parabolic reflectors, horns and resonant chambers.



## FALL PROGRAM

Many courses offered in this bulletin will undoubtedly be repeated in the fall, together with a number of new offerings.

Some courses previously available are not presented in this series but will be given in the fall. Included are the following:

### Alternating Currents (105A)

(ENGINEERING 261)

*Part Time Evening Course*

*Length of Course.* Twelve weeks, six hours per week.

*When Given.* Beginning Monday evening, October 2, 1944; Monday, Wednesday and Friday evenings, 7 to 9 p.m.

*Where Given.* Pierce Hall, Harvard University.

*Course Content.* Mathematics through integral calculus, alternating currents through complex quantities.

### Mathematics for Teachers (108)

*Part Time Day Program*

*Length of Course.* Fifteen weeks.

*When Given.* Beginning November 4, 1944.

*Where Given.* Lawrence Hall, Harvard University.

*Course Content.* The course is designed for successful, experienced teachers of subjects other than mathematics who wish to equip themselves to teach in this field.

### Vacuum Tubes and Radio Circuits (105B)

(ENGINEERING 262)

*Part Time Evening Course*

*Length of Course.* Twelve weeks — six hours per week.

*When Given.* Beginning Monday evening, October 2, 1944; Monday, Wednesday and Friday evenings, 7 to 9 p.m.

*Where Given.* Graduate School of Engineering, Harvard University.

*Course Content.* Vacuum tubes and radio engineering, including introduction to ultra-high-frequency circuits.